

FLOOD INSURANCE STUDY



**CITY OF NEPTUNE BEACH,
FLORIDA**

DUVAL COUNTY

APRIL 17, 1989



Federal Emergency Management Agency

COMMUNITY NUMBER 120079

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

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FLOOD INSURANCE STUDY

CITY OF NEPTUNE BEACH, DUVAL COUNTY, FLORIDA

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study revises and supersedes a previous Flood Insurance Study for the City of Neptune Beach, Duval County, Florida (Reference 1). This information will be used by the community to update existing floodplain regulations as part of the regular phase of the National Flood Insurance Program. The information will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by Engineering Methods and Applications, Inc., (EMA) (the Study Contractor) for the Federal Emergency Management Agency (FEMA), under Contract No. EMW-84-C-1610. EMA performed the coastal storm surge analyses for the Intracoastal Waterway and the Atlantic Ocean. The wave height, erosion, and wave run-up analyses were performed by FEMA. This study was completed in September 1987.

1.3 Coordination

The initial coordination meeting was held on April 24, 1984, and attended by representatives of FEMA, the Study Contractor, the Neptune Beach Building Department, and the Neptune Beach City Clerk.

The following were also contacted for coordination of information for this study: the University of Florida, Bureau of Economic and Business Research; the Civil Defense Department; Constance C. Cummings, Irrigation Consultant; the U.S. Army Corps of Engineers (COE), Jacksonville District; England, Thims, and Miller, Inc.; the Florida Department of Transportation; the Florida East Coast Railway; the Florida Game and Freshwater Fish Commission; Greene, Greene, Falck and Coalson, P.A.; the Jacksonville

Electric Authority; the Jacksonville Library; the Jacksonville Times Union; the National Ocean Service; the National Weather Service; the Northeast Florida Regional Planning Council; Prosser, Hallock & Kristoff, Inc.; Robert Angas Associates; Smith and Gillespie Engineers, Inc.; the St. Johns River Water Management District; the U.S. Climatic Survey; St. Johns and Duval Counties; the U.S. Department of Agriculture; and the U.S. Geological Survey.

On June 9, 1988, the results of this Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Neptune Beach, Duval County, Florida. The area of study is shown on the Vicinity Map (Figure 1).

A detailed coastal flooding analysis was performed on the complete coastline of the City of Neptune Beach, where the flooding sources are the Intracoastal Waterway and the Atlantic Ocean.

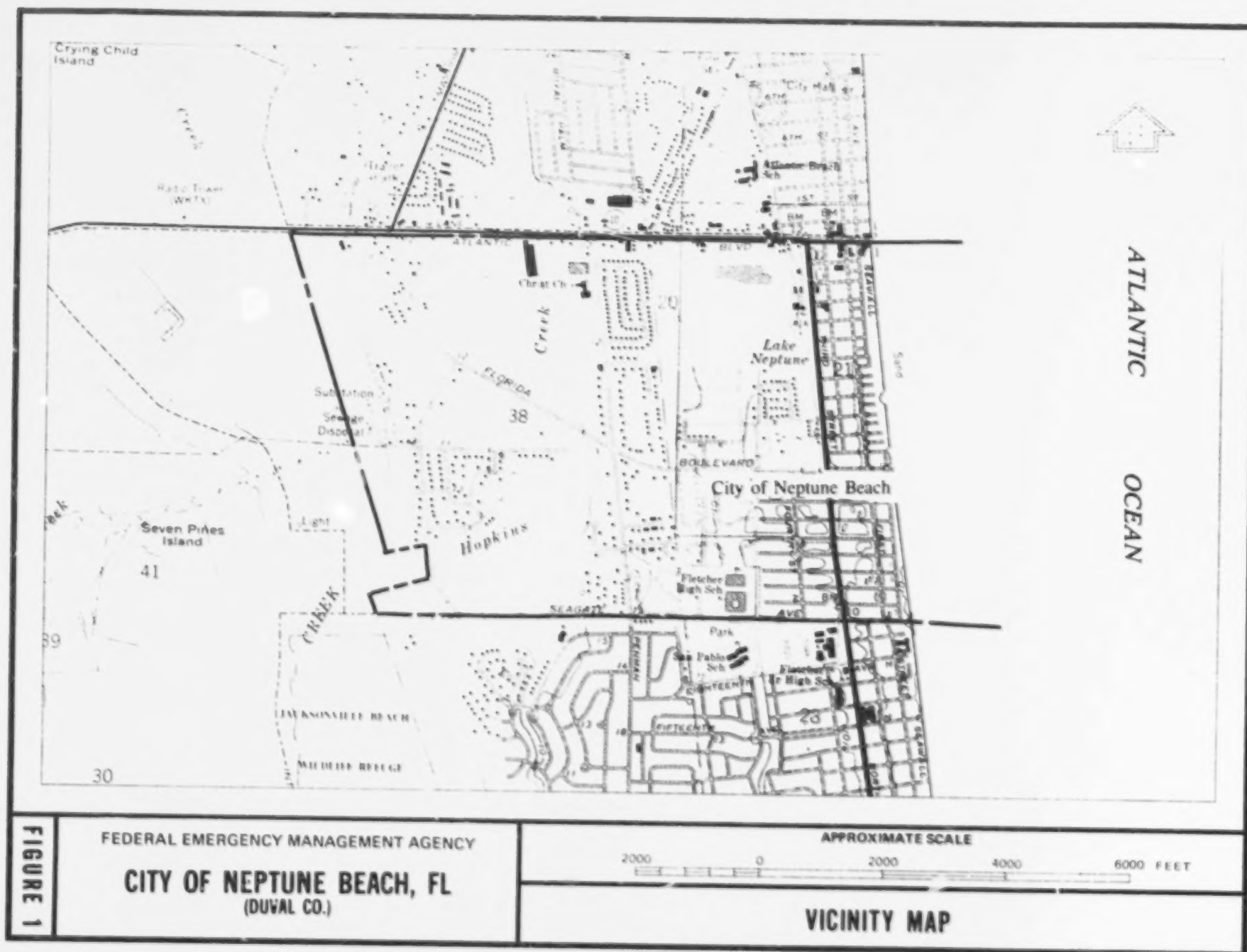
The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through September 1992. The scope and methods of study were proposed to and agreed upon by FEMA and the City of Neptune Beach.

2.2 Community Description

The City of Neptune Beach, in the northeastern coastal region of Florida, is bordered on the north by the City of Atlantic Beach, on the west by the Intracoastal Waterway and the City of Jacksonville, on the south by the City of Jacksonville Beach, and on the east by the Atlantic Ocean. The community is served by State Road A1A. The 1980 population of the City of Neptune Beach was reported to be 5,248 (Reference 2).

Because the city borders the Atlantic Ocean and the Intracoastal Waterway, tourism and recreation are important local industries.

The climate of the community is characterized by long, warm, humid summers and mild winters. The average temperature is about 53 degrees Fahrenheit (°F) in January and 81 °F in August; the annual mean temperature is about 68 °F. The average annual rainfall is about 53 inches, with the heaviest period of rainfall occurring from June through October (Reference 3).



2.3 Principal Flood Problems

Flooding in the City of Neptune Beach results from two major sources: rainfall runoff causing overflow of streams, ponding, and sheetflow; and hurricane storm surge causing extreme water levels in coastal and tidal regions. Wave action that accompanies northeasters can also cause coastal flooding and serious erosion, although extreme (100-year) flooding levels are not to be expected from such storms. Heavy rainfall can occur with hurricanes, tropical storms, northeasters, or localized thunderstorms. Because of the flat terrain, many inland areas experience shallow flooding and ponding after heavy rainfall.

Hurricanes and tropical storms are most likely to occur in September and October, although one of the most severe hurricanes to affect the community occurred in July 1926. The strongest storm in recent history to affect the region was Hurricane Dora of September 1964. Dora is the only storm to have produced hurricane-strength winds at Jacksonville Airport. Traveling almost due west, with its eye passing to the south, Dora produced maximum effects in the Neptune Beach area; furthermore, it crossed the coast during normal high tide, compounding its flooding potential. Tides five to seven feet above normal affected the coastal regions; levels five feet above normal were observed on the St. Johns River near the border of Clay County and the City of Jacksonville, Florida.

Although Dora is the most severe storm in recent history to have affected Duval County, it should be noted that it was, nevertheless, a minimum-strength hurricane; far stronger storms have occurred in other coastal regions along the Atlantic Ocean both south and north of the community.

The most recent significant storm in the area was the Thanksgiving northeaster of 1984. Although this storm did not cause flooding at extreme levels, it did result in a great deal of erosion affecting the entire northeast coast of Florida.

Although heavy rains can also cause widespread flooding in the community, flood depths and damage are not extreme compared to the potential coastal hazard.

2.4 Flood Protection Measures

The City of Neptune Beach is partially protected from the Atlantic Ocean by a seawall. In areas where the seawall is concrete, it should not fail during the 100-year event. Erosion would be limited to areas seaward of the seawall, while wave setup and runup would cause overtopping of the seawall and shallow flooding landward. Timber sections of the seawall would probably be destroyed during the 100-year event. For those sections, some erosion would occur behind the seawall and wave setup and runup would contribute to the flood hazard.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that is expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1-percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Analyses were carried out to establish the peak elevation-frequency relationships for each flooding source studied in detail.

Inundation from the Intracoastal Waterway and the Atlantic Ocean caused by passage of storms (storm surge) was determined by the joint probability method (Reference 4). The storm populations were described by probability distributions of five parameters that influence surge heights. These parameters were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were statistically described based on an analysis of observed storms in the vicinity of the City of Neptune Beach. Primary sources of data for this analysis were "Tropical Cyclones of the North Atlantic Ocean" (Reference 5); "Some Climatological Characteristics of Hurricanes and Tropical Storms, Gulf and East Coasts of the United States" (Reference 6); and "Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States" (Reference 7); all by the National Oceanic and Atmospheric Administration. A summary of the parameters used for the area is presented in Table 1, Parameter Values for Surge Elevations.

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model (Reference 8) was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the five storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	17	30	45	60	74	84
ASSIGNED PROBABILITIES	0.38	0.29	0.18	0.08	0.06	0.01
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	13		22		31	
PROBABILITY	0.33		0.33		0.33	
FORWARD SPEED (KNOTS)		8			13	
PROBABILITIES		0.50			0.50	
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)		270			310	
PROBABILITY		0.10			0.13	
FREQUENCY OF STORM OCCURRENCE (STORM/NAUTICAL MILE/YEAR)			.00117			

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEPTUNE BEACH, FL
(DUVAL CO.)

**PARAMETER VALUES FOR SURGE ELEVATIONS
ENTERING**

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	17	30	45	60	74	84
ASSIGNED PROBABILITIES	0.38	0.29	0.18	0.08	0.06	0.01
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)		16			29	
PROBABILITY		0.50			0.50	
FORWARD SPEED (KNOTS)		8			13	
PROBABILITIES		0.50			0.50	
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)				350		
PROBABILITY				0.20		
FREQUENCY OF STORM OCCURRENCE (STORM NAUTICAL MILE YEAR)		.00120				

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEPTUNE BEACH, FL
(DUVAL CO.)

PARAMETER VALUES FOR SURGE ELEVATIONS
ALONGSHORE

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	14	27	37	46	54
ASSIGNED PROBABILITIES	0.58	0.27	0.08	0.06	0.01
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	16			25	
PROBABILITY	0.50			0.50	
FORWARD SPEED (KNOTS)	9			20	
PROBABILITIES	0.60			0.40	
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)			40		
PROBABILITY			0.57		
FREQUENCY OF STORM OCCURRENCE (STORM/NAUTICAL MILE/YEAR)			.00280		

TABLE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEPTUNE BEACH, FL
(DUVAL CO.)

PARAMETER VALUES FOR SURGE ELEVATIONS
EXITING

scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total stillwater level.

Wave setup was determined to significantly contribute to the total stillwater flood levels along the Atlantic Ocean coastline. The amount of wave setup was calculated using the methodology outlined in the COE "Shore Protection Manual" (Reference 9).

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the City of Neptune Beach and are shown in Table 2, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and include the contributions from wave action effects.

3.2 Hydraulic Analyses

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

The FEMA storm surge model (Reference 8) was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 by 5 nautical miles and 1 by 1 nautical mile, depending on the resolution required.

Underwater depths and land heights for the model grid systems were obtained from topographic maps (Reference 10) and aerial photographs (Reference 11).

The methodology for analyzing the effects of wave heights associated with coastal storm surge flooding is described in a report prepared by the National Academy of Sciences (Reference 12). This method is based on the following major concepts. First, depth-limited waves in shallow water reach a maximum breaking height that is equal to 0.78 times the stillwater depth. The wave crest is 70 percent of the total wave height above the stillwater level. The second major concept is that wave height may be diminished by dissipation of energy due to the presence of obstructions, such as sand dunes, dikes and seawalls, buildings, and vegetation. The amount of energy dissipation is a function of the physical characteristics of the obstruction and is determined by prescribed procedures (Reference 12). The third major concept is that wave height can be regenerated in open fetch areas due to the transfer of wind energy to the water. This added energy is related to fetch length and depth.

Wave heights were computed along transects (cross-section lines) located along the coastal areas, as shown in Figure 2, Transect Location Map, in accordance with the FEMA "Users Manual for Wave Height Analysis"

FLOODING SOURCE AND TRANSECT	FLOOD INSURANCE RATE MAP PANEL	STILLWATER ELEVATION (FEET NGVD)				ZONE	BASE FLOOD ELEVATION ^{1,2} (FEET NGVD)
		10 YEAR	50 YEAR	100 YEAR	500 YEAR		
ATLANTIC OCEAN	001	6.6		11.0 ⁴	12.0	VE	21 ³
		3.4		5.9	8.0	AE	6-8
	001	5.6		10.9 ⁴	12.1	VE	14-17 ³
		3.4		5.4	7.3	AE	5-7

¹ROUNDED TO THE NEAREST FOOT AND MAY INCLUDE EFFECT OF WAVE ACTION

²DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR ZONES DEPICTED

³INCLUDES EFFECT DUE TO WAVE RUNUP

⁴INCLUDES EFFECT DUE TO WAVE SETUP

TABLE 2	FEDERAL EMERGENCY MANAGEMENT AGENCY CITY OF NEPTUNE BEACH, FL (DUVAL CO.)	SUMMARY OF STILLWATER ELEVATIONS
		ATLANTIC OCEAN

10



ATLANTIC OCEAN

FIGURE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF NEPTUNE BEACH, FL
(DUVAL CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

TRANSECT LOCATION MAP

(Reference 13). The transects were located with consideration given to the physical and cultural characteristics of the land so that they would closely represent conditions in their locality. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, they were spaced at large intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Each transect was taken perpendicular to the shoreline and extended inland to a point where wave action ceased. Along each transect, wave heights and elevations were computed considering the combined effects of changes in ground elevation, vegetation, and physical features. The stillwater elevations for the 100-year flood were used as the starting elevations for these computations. Wave heights were calculated to the nearest 0.1 foot, and wave elevations were determined at whole-foot increments along the transects. The location of the 3-foot breaking wave for determining the terminus of the V zone (area with velocity wave action) was computed at each transect. Also, along the open coast, the V zone designation applies to all areas seaward of the heel of the primary dune system. Table 3 provides a listing of the transect locations and stillwater starting elevations, as well as initial wave crest elevations.

TABLE 3 - TRANSECT LOCATIONS, STILLWATER STARTING ELEVATIONS, AND INITIAL WAVE CREST ELEVATIONS

TRANSECT	LOCATION	ELEVATION (FEET)	
		STILLWATER ¹	WAVE CREST ²
1	From the Atlantic Ocean coastline about 1,900 feet south of Atlantic Boulevard, extending west	11.0	21
2	From the Atlantic Ocean coastline about 2,000 feet south of Seagate Avenue, extending west	10.9	17

¹ includes effects of wave setup

² rounded to nearest foot and includes effect of wave runup

Dune erosion was taken into account along the coastline of Neptune Beach (Reference 14).

In addition to the wave height analysis, wave runup was examined along the Atlantic Ocean coastline of Neptune Beach and computed using the FEMA "Manual for Wave Runup Analysis, Coastal Flood Insurance Studies" (Reference 15). The area of Neptune Beach affected by wave runup was designated as a shallow flooding area.

Figure 3 represents a sample transect that illustrates the relationship between the stillwater elevation, the wave crest elevation, the ground elevation profile, and the location of the V/A zone boundary.

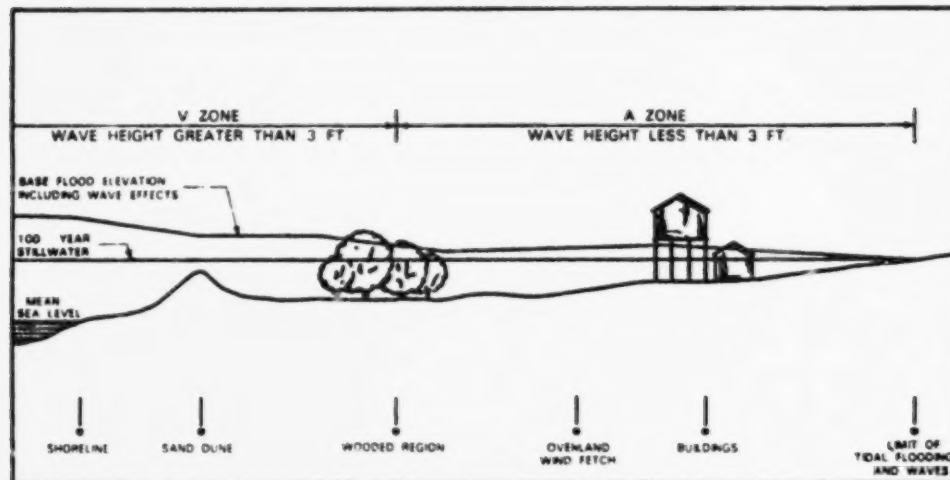


FIGURE 3 - Transect Schematic

After analyzing wave heights along each transect, wave elevations were interpolated between transects. Various source data were used in the interpolation, including topographic maps (Reference 10), beach profiles, aerial photographs (Reference 11), and engineering judgment. Controlling features affecting the elevations were identified and considered in relation to their positions at a particular transect and their variation between transects.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the map and described in the exhibit labeled Elevation Reference Marks.

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound floodplain management programs. Therefore, each Flood Insurance Study provides 100-year flood elevations and delineations of the 100- and 500-year floodplain boundaries to assist communities in developing floodplain management measures.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1-percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each flooding source studied in detail, the 100- and 500-year floodplain boundaries have been delineated using the flood

elevations determined at each transect. Between transects, the boundaries were interpolated using topographic maps at a scale of 1:24000 with a contour interval of 10 feet (Reference 10) and aerial photographs (Reference 11).

The 100- and 500-year floodplain boundaries are shown on the Flood Insurance Rate Map. On this map, the 100-year floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A, AE, AH, AO, A99, V, and VE) and the 500-year floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 100- and 500-year floodplain boundaries are close together, only the 100-year floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the flooding sources studied by approximate methods, only the 100-year floodplain boundary was delineated using the Flood Insurance Rate Map for the City of Neptune Beach (Reference 1).

5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AO

Zone AO is the flood insurance rate zone that corresponds to the areas of 100-year shallow flooding (usually sheet flow on sloping terrain) where average depths are between 1 foot and 3 feet. Average whole-foot depths derived from the detailed hydraulic analyses are shown within this zone.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 100-year floodplain, areas of 100-year flooding where average depths are less than 1 foot, areas of 100-year flooding where the contributing drainage area is less than

1 square mile, and areas protected from the 100-year flood by levees. No base flood elevations or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The Flood Insurance Rate Map is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 100-year floodplains that were studied by detailed methods, shows selected whole-foot base flood elevations or average depths. Insurance agents use the zones and base flood elevations in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols the 100- and 500-year floodplains.

7.0 OTHER STUDIES

Revisions to the published Flood Insurance Studies are in progress for the Cities of Jacksonville, Jacksonville Beach, and Atlantic Beach, Florida (References 16-18). Those revised studies are in agreement with this study.

This Flood Insurance Study supersedes the previously published Flood Insurance Study for the City of Neptune Beach (Reference 1).

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, 1371 Peachtree Street, NE, Suite 736, Atlanta, Georgia 30309.

9.0 REFERENCES AND BIBLIOGRAPHY

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10. U.S. Geological Survey, 7.5 Minute Series Topographic Maps, Scale 1:24000, Contour Interval 10 Feet: Jacksonville Beach, Florida, 1964, photorevised 1981.
11. Florida Department of Transportation, Duval County Aerial Photographs (stereo pairs), 1984.
12. National Academy of Sciences, Methodology for Calculating Wave Action Effects Associated with Storm Surges, Prepared by a Panel of the Science and Engineering Program on the Prevention and Mitigation of Flood Losses, Building Research Advisory Board Commission on Socio-Technical Systems, National Research Council, 1977.
13. Federal Emergency Management Agency, Users Manual for Wave Height Analysis, February 1981.
14. Hill, J., and Herchenroder, B., Computation Model for Computing Dune Erosion, Proceedings from ASCE Hydraulics Specialty Conference, Orlando, Florida, August 1985.
15. Federal Emergency Management Agency, Manual for Wave Runup Analysis, Coastal Flood Insurance Studies, November 1981.
16. ———, Flood Insurance Study, City of Jacksonville, Duval County, Florida, December 1983, revision in progress.
17. ———, Flood Insurance Study, City of Jacksonville Beach, Duval County, Florida, April 1983, revision in progress.
18. ———, Flood Insurance Study, City of Atlantic Beach, Duval County, Florida, April 1983, revision in progress.

ELEVATION REFERENCE MARKS

<u>REFERENCE MARK</u>	<u>FLOOD INSURANCE RATE MAP PANEL</u>	<u>ELEVATION (FEET NGVD)</u>	<u>DISCRIPTION OF LOCATION</u>
1	0001	12.85	top of concrete post located southeast of intersection of 3rd Street South and Pine Street